

The Tongue River Dam Project

Summary Report

presented to the
Forty-Seventh Legislature

by the
Department of Natural Resources and Conservation
Water Resources Division
Helena, Montana
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TONGUE RIVER DAM PROJECT

SUMMARY REPORT

INTRODUCTION

In its present condition, the Tongue River Dam would fail in a moderately large flood. The project's benefits would be lost. Downstream property would be destroyed. Most importantly, people would be killed. In recognition of this danger, the 46th Legislature directed the Department of Natural Resources and Conservation (DNRC) to analyze economic and geotechnical aspects of the project in pursuit of measures to make it safe. This report summarizes DNRC's response to this mandate. A full report, documenting the details of DNRC's findings, is forthcoming.

RECOMMENDATION

DNRC recommends that the present Tongue River Dam be raised, the reservoir capacity increased, and the spillway enlarged as a joint State/Federal/Northern Cheyenne Tribe project. This project would make the dam safe, increase the existing project's benefits, may lead to a resolution of Indian/non-Indian water rights conflicts, and is the least-cost alternative for the state.

PROJECT OBJECTIVES

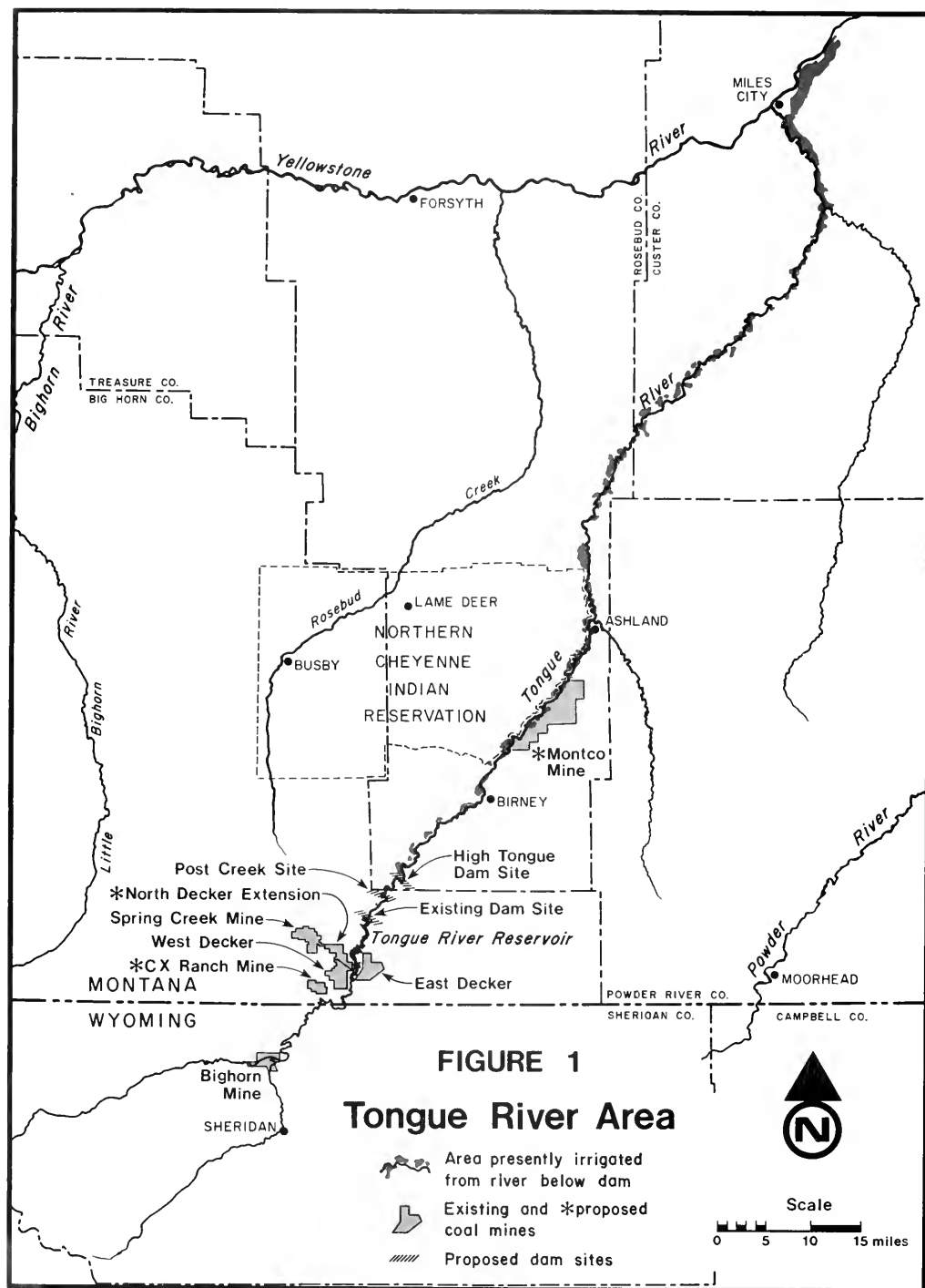
In reaching this recommendation, DNRC evaluated five alternative projects against the following four criteria:

1. The unsafe condition of the existing dam must be corrected;
2. Present project benefits (agricultural water supply, flood control, recreation and others) should be maintained and, if possible, increased;
3. The conflict over Indian/non-Indian water rights on the Tongue River should be resolved; and
4. While satisfying the other objectives, the project should be the least-cost alternative to the State of Montana.

The unsafe condition of the existing dam must be corrected. A flood capable of washing out the existing dam can be expected to occur once every 68 years. The dam was in serious danger of failing during the spring flood of 1978. In fact, the dam would have failed during the 1923 flood had it been in place at that time. The dam would fail because the spillway (normally designed to pass flood flows over the dam without damage) is too small. Failure would cause devastating property damage downstream along the Tongue River and to the communities of Birney and Ashland. Lives would likely be lost. The high probability of failure combined with potential property damage and loss of life downstream mandate that the project be made safe.

Modern dam safety standards indicate that dams similar to the one on the Tongue River be large enough to safely pass the probable maximum flood, that is to say, the streamflow that would occur under the most severe combination of extreme weather and watershed conditions. A preliminary calculation indicates that the probable maximum flood at the Tongue River Dam may be as high as 400,000 cubic feet per second (cfs) as compared to the 1978 flood peak of 19,000 cfs. Building a spillway to safely pass this large flow represents a major cost of each construction alternative. Breaching the dam would eliminate the danger of the dam failing, but it would also eliminate the benefits of the reservoir, including the small amount of flood protection the dam provides.

Present project benefits (agricultural water supply, flood control, recreation and others) should be maintained and, if possible, increased. The present reservoir's 68,000-acre-foot capacity currently provides a firm annual yield of 40,000 acre-feet, which is used to fully or partly irrigate 18,500 acres of land and provide some stockwater. The Bureau of Indian



Affairs purchases 7,500 acre-feet of water for use on the Northern Cheyenne Reservation. The US Fish and Wildlife Service purchases stored water for its fish hatchery near Miles City. Montana Power Company has an option of 4,000 acre-feet and the Decker Coal Company currently purchases 175 acre-feet for industrial use. In addition, the reservoir stores spring runoff that would otherwise cause downstream flood damage. The reservoir is a prime flat-water recreation area for local residents in Montana and Wyoming. Downstream flows, stabilized by the dam, provide excellent fish habitat. In short, the Tongue River Dam is an essential part of life in southeastern Montana and should be maintained. Many benefits of the project could be increased if additional water storage were provided. The Board of Natural Resources and Conservation, in establishing water allocation policy in the Yellowstone River Basin, endorsed additional water storage on the Tongue River by reserving water for that purpose.

The conflict over Indian/non-Indian water rights on the Tongue River should be resolved. The natural flow of the Tongue River cannot fully supply either the reserved water rights claimed by the Northern Cheyenne Tribe or the water rights perfected by non-Indians through beneficial use and appropriation under Montana water law. In fact, litigation to quantify these rights is ongoing and is expected to be lengthy and costly. The water rights issue presents both a problem and an opportunity. On one hand, it is apparent that an enlarged project cannot be built unless water rights are available to fulfill the purposes of the project and, on the other hand, an enlarged project may be the key to solving the water rights conflict by supplying adequate water supplies to all water users. The tribe has expressed interest in a water project that would amicably resolve the conflict outside the court room and benefit both the tribe and other users.

The project should be the least-cost alternative to the State of Montana. The state should only participate in a project when the first three project objectives can be satisfactorily achieved at minimum cost to the state.

PROJECT ALTERNATIVES

The DNRC evaluated five basic alternatives that meet to some degree the project objectives. These alternatives are:

1. Building a larger spillway at the existing dam;

2. Raising the existing dam, increasing the reservoir capacity, and building a larger spillway;
3. Breaching the dam;
4. Building a larger project at the Post Creek site;
5. Building a larger project at the high Tongue dam site.

Several of these alternatives have been considered with and without coal-mining options. These alternatives are summarized in Table 1.

Building a larger spillway at the existing dam could be done in two ways—without mining and with mining. If the no-mining option is taken, the existing spillway would be modified to accommodate larger flows. An emergency spillway would be built to pass the rest of the probable maximum flood. The reservoir would then be brought up to full development producing a firm annual yield of up to possibly 52,000 acre-feet per year from a 68,000-acre-foot capacity.

If the mining option is taken, a new spillway capable of handling the probable maximum flood would be built and equipped with gates so that the water level would be adjusted to accommodate the mining operation on the reservoir's floor. Upon completion of the mining operation, the reservoir would be brought up to full development producing up to possibly 52,000-acre-feet firm annual yield from a 68,000-acre-foot capacity. The mining option would require that the reservoir's firm annual yield be drastically reduced to 14,500 acre-feet for 11 years.

Either way, the alternative would satisfy the first project objective by providing for the passage of the probable maximum flood, thereby making the project safe.

The second objective would also be met because this alternative would preserve the existing project benefits and could also increase the firm water supply by possibly 12,000 acre-feet per year. This increase would be possible (even though the total capacity would remain unchanged) because the reservoir could be more fully used with a larger spillway in place.

It is doubtful, however, that this small increase in the firm water supply would be sufficient to meet all future water demands, and therefore this alternative would do little to resolve the Indian/non-Indian water rights conflict. Consequently, the third objective would not be met.

In the opinion of DNRC the least-cost objective could not be satisfied by this alternative. Generation of hydropower (1.95 MW) would be unlikely to repay the cost of installing the hydroelectric facilities. Revenue generated from mining DNRC-owned coal

TABLE 1

TONGUE DAM ALTERNATIVES



OPTION DESCRIPTION: Water Storage Elev. (Feet above mean sea level)	Repair Existing Dam		Enlarge Existing Dam		Post Creek Dam		High Tongue Dam		Breach Dam	Current Dam
	No Mining	Mine existing reservoir	No Mining	Mine existing reservoir	Mine existing reservoir	Mine existing reservoir	Mine existing reservoir	Mine downstream and existing reservoir		
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Surface Area(acres)	3300	3424.4	3438	5000	3438	3438	3438	3438	N/A	3424.4
Storage Capacity (ac-ft) during mining	N/A	17,000	N/A			62,000	126,000	68,000 to 126,000	N/A	N/A
full development	68,000	68,000	130,000	130,000	130,000	223,000	320,000	320,000	0	68,000
Firm Annual Yield (ac-ft) during mining	N/A	14,500	N/A		14,500	46,000	81,000	40,000 to 81,000	N/A	N/A
full development	52,000	52,000	82,000	82,000	82,000	106,000	118,000	118,000	0	40,000
Tons Recoverable Coal	N/A	47,700,000	N/A	N/A	47,700,000	47,700,000	47,700,000	128,900,000	None	N/A
Total Estimated Cost	\$67,270,000	\$106,499,000	\$77,789,000	\$108,024,000	\$160,263,000	\$182,295,000	\$211,128,000	\$9,716,000	N/A	N/A
Annual Cost of Water per acre- foot ²	\$118	\$138	\$87	\$89	\$114	\$119	\$142	N/A	N/A	N/A

* Annual cost is the initial cost of water amortized over 50 years at 9% interest.
 Annual cost of water in coal mining options has been offset by present value of coal revenues.

under the existing reservoir would be substantial—about \$39 million. However, coal mining would require expensive gated spillways, raising the cost of a dam without coal mining by \$39 million. Regardless, it is uncertain whether coal mining would be permitted in the Tongue River Valley.

In the opinion of the Department, it is unlikely that congress would appropriate funds to cover much of the project costs because the incremental cost of water from this project is more than other alternatives.

With three-fourths approval of the legislature, DNRC could use coal severance tax funds to finance this alternative; however, the drawdown on this fund may not be justified by the relatively smaller project benefits.

Raising the existing dam, increasing the reservoir capacity, and enlarging the spillway could be accomplished in two ways—with mining and without mining. If the no-mining option were to be taken, the dam would be raised and a new spillway would be installed. With construction complete the reservoir would be brought up to full development producing 82,000-acre-feet firm annual yield from a 130,000-acre-foot capacity.

If the mining option were to be taken the dam would be raised and a spillway with gates installed. The gates would allow adjustment of the water level to accommodate the mining operation on the reservoir's floor. Upon completion of the mining operation, the reservoir would be raised to full development producing 82,000-acre-feet firm annual yield from a 130,000-acre-foot capacity. The mining option would require the reservoir's firm annual yield to be reduced for 11 years.

This alternative would fully satisfy the first objective by providing a spillway that could pass the probable maximum flood. This alternative would satisfy the second objective by preserving the existing benefits and increasing the firm annual yield by 42,000 acre-feet per year.

The Northern Cheyenne Tribe has indicated that it would be interested in this or other alternatives that would provide additional water storage. The tribe is evaluating each alternative project that would increase water supply to determine which project best meets their present and future needs. This alternative, therefore, may lead to a resolution of the Indian water right conflict.

In the opinion of DNRC, this alternative could meet the first three project objectives at a reasonable cost to the state. Sale of water would not repay project costs unless industrial customers

could be found. This, however, is unlikely in the near future. Generation of hydropower would provide little revenue. In fact, hydropower revenue is unlikely to repay the cost of installing the 2.6-MW hydroelectric facilities.

As with the previous alternative, coal mining was considered as an optional means to pay for project costs. However, the same conclusion was reached—coal mining revenues to DNRC would be about \$39 million but would increase project costs from \$77 million to \$108 million. However, DNRC believes that this project can be built at minimal cost to the state. Of all the projects considered, this one appears to have the best chance of congressional appropriation to fund project construction. This appears to be justified if the project would be a joint State/Federal/Northern Cheyenne Tribe project. DNRC would contribute existing project assets, water rights, and planning efforts to the project while the federal government would, through the Bureau of Indian Affairs and the Northern Cheyenne Tribe, finance project construction. DNRC may also be required to cost-share project costs. Project water sold by DNRC would at least partially offset the DNRC cost share.

Breaching the dam, would eliminate the hazard the dam poses as well as all the benefits it provides.

This alternative would satisfy the first objective in making the project safe by removing the dam. On the other hand, it would also remove the small amount of flood control the present project provides. The second objective would not be met, since all project benefits would be lost. The Indian/non-Indian water rights conflicts would not be resolved by this alternative, thus, the third objective would not be met.

The cost of breaching the dam could be repaid by sale of the land under the reservoir. However, the existing project benefits would be lost and the Indian/non-Indian water rights conflict would not be solved indicating that the least-cost objective would not be fully satisfied.

Building a larger project at Post Creek would involve building a larger dam near the mouth of Post Creek, removing the present dam, and mining the coal lying beneath the present reservoir. DNRC did not investigate a no-mining option for this alternative.

Once the Post Creek dam would be complete, its spillway gates would allow the new reservoir to be operated at a 62,000-acre-foot capacity producing 46,000-acre-feet firm annual yield. Operating the reservoir at this capacity would allow mining to con-

tinue on the old reservoir's floor. Once the old dam would be removed and the mining operation completed, the reservoir would be brought up to full development producing 106,000-acre-feet firm annual yield from a 223,000-acre-foot capacity.

This alternative would result in a safe project that preserves the present project's benefits and increases the firm annual yield by 66,000 acre-feet, thereby satisfying the first and second objectives.

The Northern Cheyenne Tribe has indicated that it would be interested in this or other alternatives that would provide additional water storage. The tribe is evaluating each alternative project that would increase water supply to determine which project best meets their present and future needs. This alternative, therefore, may lead to a resolution of the Indian water right conflict.

This alternative does not appear economically attractive. Unless a large industrial water market appears in the area, water sales would not be sufficient to pay for the project. Revenue generated by hydropower would do little more than pay for installation of the power plant. Revenue from the mining operation would bring in \$39 million but would also mean raising the cost of the project by almost as much. It is uncertain that coal mining would be permitted in the Tongue River Valley. The likelihood of a congressional appropriation for the project appears less likely than for raising the present dam.

Building a larger project at the high Tongue dam site could be accomplished in two ways. The first option involves building the high Tongue dam at a site approximately seven miles downstream from the present Tongue River Project and mining coal lying beneath the present reservoir and in the area between the present dam and the high Tongue dam site. The new reservoir's 320,000-acre-foot capacity would produce a firm annual yield of 118,000 acre-feet per year.

Since the mining operations would take a significant amount of time, the first step would have to be to build a temporary emergency spillway at the present dam site. During the mining operations between the sites, the high Tongue dam would be constructed with a gated spillway that could adjust the new reservoir's level to accommodate the mining operation on the floor of the present reservoir. Once the coal beds would be exhausted, the reservoir level would be raised to full development.

The second option would result in the same water project as the first option—a dam at the new High

Tongue site stacking up 320,000 acre-feet and producing a firm annual yield of 118,000 acre-feet per year. The only difference between the two alternatives would be the extent of coal mining. In the second option, only the coal lying beneath the present reservoir would be mined. The gated spillway on the high Tongue dam would allow coal mining along the upstream shore of the reservoir. Once the mining operations would be completed, the reservoir would be brought up to full development.

This alternative would meet the first objective through construction of a safe dam. The existing dam would be breached.

The second objective would also be met because this alternative would preserve the existing project benefits and increase the firm water supply by 78,000 acre-feet per year.

The Northern Cheyenne Tribe has indicated that it would be interested in this or other alternatives that would provide additional water storage. The tribe is evaluating each alternative project that would increase water supply to determine which project best meets their present and future needs. This alternative, therefore, may lead to a resolution of the Indian water right conflict.

It is the opinion of DNRC that this alternative would not be economically attractive at this time. Sale of stored water would not repay project costs unless industrial customers could be found. There appears to be no market for industrial water in the near future. Generation of hydropower would be unlikely to repay the cost of installing the hydroelectric facilities (6.6 MW).

Coal mining would generate substantial revenues (\$39 million) toward project cost repayment. However, it is uncertain that mining coal in the Tongue River Valley would be permitted.

DNRC would not receive revenues from coal mining between the two dams since it does not own that coal. Coal mining there would, however, obviate the need for DNRC to purchase that coal prior to it being inundated by the reservoir. Total project cost for the dam assuming mining in both areas is \$211,128,000, while total project cost with mining only under the existing reservoir is \$182,295,000.

Congressional appropriation for funding project construction would not be as likely as for raising the present dam. Without federal funds, the state would have to provide about \$140 million for project construction, perhaps from the coal severance tax. Obviously, this expenditure would deplete a large share of the severance tax fund.

PROJECT SELECTION AND IMPLEMENTATION

DNRC recommends that the present Tongue River Dam be raised, the reservoir capacity increased, and the spillway enlarged as a joint State/Federal/Northern Cheyenne Tribe project. This project would eliminate the danger to life and property. It would preserve and increase the present Tongue River Project's benefits. In DNRC's opinion, it would produce a sufficient firm annual yield to supply most, if not all, current and future water needs in the area, thereby providing a mechanism that may resolve the Indian/non-Indian water rights conflict. Finally, it would be the least-cost alternative for the state since, through participation by the Northern Cheyenne Tribe and the federal government, Congress would probably fund most of the project's \$77,789,000 price tag.

Reservoir operation would be managed by a contractual agreement between the project sponsors. A water rights compact, indicating the allocation of Tongue River water between Indian and non-Indian water users, would have to be ratified by the legislature, the tribal council and Congress.

Project cost would be paid by Congressional appropriation, with the state possibly sharing the cost (5 to 10 percent based on present administration requirements) and contributing project assets. This alternative coincides with federal water policy which calls for, whenever possible, state-federal cooperation, elimination of unsafe dams, and negotiation rather than litigation with Indian tribes.

If each phase of project pre-construction and construction schedule proceeded as planned the project could be in place as early as October 1990.

In order to implement the recommended alternative, DNRC is requesting \$430,000 for the next biennium to complete the following tasks:

1. Participate with the Federal Government and Northern Cheyenne Tribe in federally-funded feasibility studies which are necessary to obtain congressional appropriation for the project.
2. Cooperate with the Northern Cheyenne Tribe and the Reserved Water Rights Compact Commission to reach a negotiated settlement of the tribe's water right in conjunction with the project.
3. Drain the existing Tongue River Reservoir until the larger and safer project is completed.
4. Develop, maintain, and advertise an emergency warning and downstream evacuation plan for residents living below the Tongue River Project.

Table 2 summarizes the budget needed to carry out these tasks.

**TABLE 2
TONGUE PROJECT BUDGET
(1981-83)**

Staff	\$200,000
Travel	40,000
Legal Costs	40,000
Computer Costs	10,000
Contracted Services:	
Environmental	50,000
Evacuation/Emergency Plan	50,000
Contingency @ 10 percent	40,000
Total	\$430,000

This budget request is included in the Water Development Program legislation being proposed by the DNRC. Each task is more fully explained below.

Participate with the Federal Government and Northern Cheyenne Tribe in federally-funded feasibility studies which are necessary to obtain congressional appropriation for the project. Staff is needed to work with the Bureau of Indian Affairs and Water and Power Resources Service in securing federal funding for the pre-construction activities. This would involve drafting a document identifying the need and value of federal funding and lobbying efforts to escort project proposals through the federal budgetary process. It appears that federal money could build a new dam on the Tongue River; however considerable time and travel would be required to ensure that the real value of this proposal is understood within the hierarchy of federal agencies so that funding could be secured.

The Tongue Project staff would also coordinate the efforts of all the agencies, firms, and individuals dealing with the project. Principal organizations would include DNRC, the Compact Commission, the Northern Cheyenne Tribe, Water and Power Resources Service, Bureau of Indian Affairs, Montana Department of Fish, Wildlife and Parks, and the Tongue River Water Users Association. Other interested parties would include landowners near the reservoir, conservation districts with water reservations and the Montana Department of State Lands. All of these agencies and organizations would be interested in the project development efforts and would be working to assist the project or to secure their interests. Close coordination of these efforts would be essential if the efforts of all these groups are to fit together smoothly.

The travel money would be needed for numerous trips to Billings and the project area to meet with project participants and interested parties.

Legal assistance will be needed to deal with water-use-contract concerns resulting from reservoir draining. The most complex legal issues would deal with the contracts for the project ownership, operation and water sales. The basic agreements needed to complete the feasibility study would be legal; therefore, funding for extensive legal services would be essential.

The money requested for contracted service would be used to get answers to technical questions and resolve technical issues for which federal funds would not be available. Principal areas would include geologic investigations and environmental concerns raised in the allocation of irrigation and in-stream flows by the Board of Natural Resources and Conservation.

The essential result of these efforts would be a federally funded dam; this budget is needed to ensure that this federally funded project would be developed as rapidly as possible and would be consistent with the state's interests in this resource-critical region.

Cooperate with the Northern Cheyenne Tribe and the Reserved Water Rights Compact Commission to reach a negotiated settlement of the tribe's water rights in conjunction with the project. It is essential that DNRC be represented in negotiations with the Northern Cheyenne Tribe. The Tongue project is a key element in the negotiations between the Reserved Water Rights Compact Commission (RWRCC) and the Northern Cheyenne Tribe. DNRC believes that the project has the potential to supply sufficient water to the tribe to provide the basis for a compact allocating water between the state and tribe. Since the federal feasibility study would not be completed until plans for the use of project water are identified, a basic agreement on water allocations would have to be agreed upon by the fall of 1982 if the 1990 project completion date is to be met. In addition to an agreement on where the water goes, there would need to be complex agreements on the project ownership and operations, cost-sharing for construction, the price charged to all water users, in-stream flows, and other issues. Developing these agreements would require time-consuming efforts in identifying key issues, researching alternatives, and drafting and discussing proposed agreements. While some of this work would be done by the RWRCC staff and all of it would be coordinated with Compact Commission efforts, some of it would

relate to issues outside the purview of the commission. A reduction in staff would slow these efforts and delay project completion.

Drain the existing Tongue River Reservoir until the larger and safer project is completed. Due to the long time needed to replace the present dam with a safe one DNRC cannot avoid consideration of the serious risks the dam imposes on downstream residents before rehabilitation is complete. A 68-year flood would probably wash out the dam if it were full when the flood came. If, however, the reservoir were half full, it would take a 117-year flood to wash it out and an empty reservoir would have sufficient flood control storage to handle up to the 295-year flood. Table 3 summarizes the risks associated with operating the dam to keep the reservoir full, half full, or empty.

TABLE 3
Chances of the Present
Tongue River Project Failing

Reservoir Operation	Flood Frequency to Wash out Dam	% Chance of Dam Failure in the Next 10 Years
Full (Current Operation)	1 in 68 years	14%
Half full (optimist)	1 in 117 years	8%
Empty (pessimist)	1 in 295 years	3%

Draining the reservoir greatly reduces the probability of a catastrophic failure. It also eliminates all project benefits. Irrigators relying on the reservoir for water would lose their entire stored water supply and recreators would find a dry reservoir. Yet in spite of these serious losses, DNRC has reluctantly concluded that the reservoir should be drained and remain empty until the dam can be replaced with a safe one. The risks are simply too great and the potential catastrophe too large to live with.

A dam-destroying flood would almost certainly come from a heavy rainstorm. Rapid snowmelt could not, without rain, produce such large inflows to the reservoir. Such a storm is most likely in the spring when normal operations would be filling the reservoir for the coming irrigation season. Safety requires that the gates in the outlet tunnel be kept open through this period so an empty reservoir would be available to catch inflows resulting from a sudden large rainstorm. There is just no way to combine reasonable safety with reliable supply of water from the reservoir.

In addition to the alternatives described earlier, DNRC priced an earthen emergency spillway with a capacity of 80,000 cfs which is one-fifth of the probable maximum flood flows. This bandaid measure would cost \$18 million and would be too expensive for the interim water supply and recreation benefits it would provide. In addition, the bandaid measure would not be as safe as the present dam for smaller floods. The absence of a feasible method for making the dam safer until a safe dam can be built makes draining the present Tongue River Project an integral part of this recommended alternative.

Develop, maintain, and advertise an emergency warning and downstream evacuation plan for residents living below the Tongue River Project. In the ten years prior to project completion there will be a possibility of dam failure and subsequent loss of life downstream. To ensure that residents living downstream of the project can be warned and/or evacuated if the dam appears to be in danger of failing the DNRC must develop and test an adequate emergency plan. The budget for this plan (\$50,000) was put together with help from local emergency experts.

In addition to presenting proposed legislation on a preferred option and funding to develop this option, DNRC's recommendation also proposes legislation to establish a financial mechanism to allow the use of coal severance tax revenues in a pledge for revenue bonds which can be sold to finance water projects throughout the state. Bonds sold under this legislation would be repaid by project revenues and

coal severance tax receipts which would otherwise be deposited in the constitutional trust fund. This financial proposal is more thoroughly explained in DNRC's report in the Water Development Program. The Tongue River Project is one component in this larger Water Development Program that is before the 1981 Legislature.

Severance tax bonds have two potential uses for the Tongue Project. The first is to share construction costs with the federal government and the second is a fall-back finance plan if federal money would become unavailable.

Presidential water policy proposals have urged that states be encouraged to cost-share federally-funded water projects and that projects with a state cost-share would move to the top of the federal project priorities list. These proposals recommended that 5 to 20 percent state cost-share would be sufficient to give special priority to a project. Congress never enacted this proposal into law. Nevertheless, the idea is popular within the federal Office of Management and Budget and a state cost-share may be useful when congress is considering construction funding for the Tongue River Dam. Severance tax bonds would be a logical means to provide the state cost-share in order to secure federal funds to replace the Tongue River Dam.

The second use of the severance tax bonding opportunity would be for a second-best financing mechanism if federal money would not be available to replace the dam. If this occurred, bonds would be sold to pay for the entire cost of the dam and severance tax revenues would be used to repay the difference between project revenues and the money needed to repay the bonds.

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